

the signs of ASL from humans and other chimpanzees. The chimpanzees used signs when conversing with each other, even when no humans were present. They used the signs to sign to themselves and in imaginary play about things that were present as well as not present. They initiated interactions with humans and appropriately adjusted their conversations to changes in the human's signs and questions. Sign language studies fill some of the gaps between humans and the rest of nature that were created in the minds of philosophers and are maintained by human arrogance.

See also Cognition—*Animal Languages, Animal Minds*
 Cognition—*Animal Consciousness*
 Cognition—*Theory of Mind*
 Gorillas—*Gorillas/Koko*

Further Resources

- Bodamer, M. D., Fouts, D. H., Fouts, R. S. & Jensvold, M. L. A. 1994. *Functional analysis of chimpanzee (Pan troglodytes) private signing*. *Human Evolution*, 9, 281–296.
- Bodamer, M. D. & Gardner, R. A. 2002. *How cross-fostered chimpanzees (Pan troglodytes) initiate conversations*. *Journal of Comparative Psychology*, 116, 12–26.
- Fouts, D. H. 1994. *The use of remote video recordings to study the use of American Sign Language by chimpanzees when no humans are present*. In: *The Ethological Roots of Culture* (Ed. by R. A. Gardner, B. T. Gardner, B. Chiarelli & F. X. Plooi), pp. 271–284. Netherlands: Kluwer Academic.
- Fouts, R. & Mills, S. T. 1997. *Next of Kin*. New York: William Morrow Publishers.
- Gardner, B. T. & Gardner, R. A. 1971. *Two-way communication with an infant chimpanzee*. In: *Behavior of Nonhuman Primates*. (Ed. by A. Schrier & F. Stollnitz), vol. 4, pp. 117–184. New York: Academic Press.
- Gardner, R. A., & Gardner, B. T. 1989. *A cross-fostering laboratory*. In: *Teaching Sign Language to Chimpanzees*. (Ed. by R. A. Gardner, B. T. Gardner & T. Van Cantfort), pp. 1–28. Albany, NY: SUNY Press.
- Jensvold, M. L. A., & Fouts, R. S. 1993. *Imaginary play in chimpanzees (Pan troglodytes)*. *Human Evolution*, 8, 217–227.
- Jensvold, M. L. A., & Gardner, R. A. 2000. *Interactive use of sign language by cross-fostered chimpanzees (Pan troglodytes)*. *Journal of Comparative Psychology*, 114, 335–346.

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■ Cognition

Theory of Mind

Theory of mind (TOM) refers to the ability to reason about the mental states—the beliefs, desires, and intentions—of other individuals. Having a TOM is considered a hallmark of human cognition. Consider, for example, the following scenario: A boy opens a cookie jar, looks inside, frowns, and walks away. Most people interpret this scene as follows: The boy *wanted* a cookie, *thought* there was a cookie inside the cookie jar, but *realized* that he was wrong. Thinking about the actions of others in such mental states terms allows our species to predict not only another individual's behavior, but their unobservable thoughts as well.

Because a TOM is so important in adult human cognition, many have become interested in both the development and evolution of our TOM abilities. Much of the developmental work on TOM uses a classic task known as a “false belief” experiment. The logic behind false

belief experiments is that children should use their TOM to think about another person's belief even when that belief is different from their own beliefs. In one version of a false belief task, an experimenter asks what a child thinks is inside a box of Smarties candy (Smarties is the British version of M&M's). Most children reply that they think Smarties are inside the box. The experimenter then opens the box to reveal something unexpected (e.g., pencils) inside the box. The experimenter then closes up the box and asks the child what another person will think is inside the box. Children older than four years of age correctly reply that another person will probably have a false belief about what's inside the box—the others will think that Smarties are in the box. Younger children, however, perform differently. They mistakenly think that others will have the same belief about the box that they do, namely that pencils are inside. Results from studies like these have demonstrated that children between three and five years of age undergo important developmental shifts in their ability to understand the beliefs of others.

Psychologists have also investigated whether other animals share our human TOM abilities. Such comparative work has focused mostly on nonhuman primates, particularly chimpanzees. A number of now classic experiments suggested that primates know very little about the minds of others. Chimpanzees, for example, watched as an experimenter stared at or pointed at one of two possible food locations. Chimpanzees chose randomly in these studies, ignoring the experimenter's intent to communicate knowledge of the food's location. Similarly, chimpanzees ignore information about what experimenters can and cannot see when choosing whether to beg for food. Recently, however, researchers have begun using more ecologically competitive tasks to ask what primates know about the mind, allowing subjects to compete against others for hidden pieces of food. These recent studies suggest that chimpanzees use information about what competitors do and do not know when vying for contested pieces of food. In contrast to previous work, these new studies hint that at least one nonhuman animal may possess some TOM abilities.

See also Cognition—*Animal Consciousness*

Cognition—*Deception*

Cognition—*Social Cognition in Primates and Other Animals*

Cognition—*Tactical Deception in Wild Bonnet Macaques*

Cognition—*Theory of Mind*

Play—*Dog Minds and Dog Play*

Play—*Social Play Behavior and Social Morality*

Further Resources

Hare, B., Call, J. & Tomasello, M. 2001. *Do chimpanzees know what conspecifics know?* *Animal Behaviour*, 61, 139–151.

Perner, J. 1991. *Understanding the Representational Mind*. Cambridge, MA: MIT Press.

Povinelli, D. J. & Eddy, T. J. 1996. *What young chimpanzees know about seeing*. *Monographs of the Society for Research in Child Development*, 61, 1–152.

Tomasello, M., Call, J. & Hare, B. 2003. *Chimpanzees understand psychological states—the question is which ones and to what extent*. *Trends in Cognitive Sciences*, 7, 153–156.

Wellman, H. 1990. *The Child's Theory of Mind*. Cambridge, MA: MIT Press.

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